

Command & Data Handling Unit (C&DH)



UNIT DESCRIPTION

The C&DH unit provides the spacecraft control processing, data handling and storage, command decoding and telemetry gathering and encoding. The MDA C&DH unit is targeted for "Small-Sat" to "Medium-SAT" C&D applications. The unit consists of a Controller based on one of MDA Enhanced Space Processor cards, an optional 2GB Mass memory card, CCSDS compliant Command Decoder and Telemetry Encoder cards with CCSDS time-tagging functions, and a scalable number of Low Power and High Power I/O cards providing an extensive selection of interfaces to Spacecraft Platform Devices with analog and digital commands and Telemetry acquisition channels to meet most C&DH system requirements.

The C&DH system is modular; with cards conforming to the standard PCI 6U (160 X 233.35 mm) form factor. All cards plug into a 6U compact PCI backplane, which provides power distribution, and high speed and low speed interconnections. Front panel D-sub connectors on the 6U I/O cards provide the external I/O to the Spacecraft platform devices. An EPC plug-in module within the chassis provides the regulated DC power to the cards within the unit. The C&DH platform is designed for the harsh environment of space: GEO, deep space and LEO missions. Its compact size and ruggedness makes it ideal for any volume or mass sensitive application.

PRELIMINARY SPECIFICATIONS

Processor	ESP032, radiation hardened processor based on the ERC32 processor, 16 MIPS at 20 MHz. Integer unit based on SPARC V7 RISC architecture, with powerful 32/64-bit Floating Point Unit. ESP032 card internal local 32-bit address bus/32-bit data bus for memory and I/O access. PCI 32-bits Bus Master interface to CPCI backplane on J1, and local CAN bus on J2.
Boot/Program Memory	64KB Start-Up PROM for firmware boot 2 MBytes 8-bits wide EEPROM with power-off mode
Data/Program Memory	4 Mbytes 32-bits wide, rad tolerant SRAM with EDAC functionality
Mass Memory (optional)	1/2 G Bytes of SDRAM (Reed Solomon Error Correcting Code), and 8 Mbytes of EEPROM Non-Volatile Memory. Optional "Spacewire" node, providing bidirectional high speed serial access to memory arrays (LVDS Xcvrs accessible through a 9 pin micro-D front-panel connectors).

INTERFACES

The number and types of I/O's is modular and can accommodate many applications by using different combinations of Low Power Telemetry and High Power Commands I/O cards.

CAN 2.0 Bus	Serial dual redundant bus at 1 Mb/s
MIL-STD-1553B	C&DH Dual redundant 1553 Data Bus Controller (BC), for communication to the AOCS sub-systems and payload.
TTC-B-01	Serial ML16 and SD16 Telemetry and Tele-commands Interfaces
High speed serial	4 high speed duplex RS-422/485 COM ports (up to 2 Mb/s), FIFO buffered.
Low speed serial	4 UARTs, full-duplex, RS-422 Xcvrs, programmable baud rate to 115.2 Kbaud

LOW POWER TELEMETRY I/O FUNCTIONS

- 48 Analog Input channels, single-ended, 13 bits resolution, for sensors telemetry I/F's: 4-wire RTD/ pressure transducers bridge, current telemetry, ..
- 16 differential analog channels (bipolar inputs) with 14-bits resolution
- 120 temperature telemetry channels with thermistors conditioning
- 2 Analog outputs of 0-10V or $\pm 5V$, with 12-bits resolution
- 60 Bi-level Telemetry channels (28 with analog levels, 32 with 0-5V levels)

HIGH POWER I/O FUNCTIONS

Stepper Motors Drive, S/C thermal control (Heaters drive), High level pulse commands (driving latching relays, Pyro actuators drive, etc.) with configurable duration.

POWER

Voltage	+22 to +36 VDC power bus input (50V and 100 VDC options available) Over-current and under-voltage protected
Power	16 to 38 Watts, depending on mode and configuration

PHYSICAL PERFORMANCE

Temperature	-30 °C to +50 °C operating Unit base temperature
Random vibration	17.5 Grms (Qualification level)
Envelope	248 H X 280 W X 231 mm D (6U form factor backplane with 8 slots chassis)
Mass	Less than 11 Kg (full configuration)
Radiation Hardness:	80 Krads TID, high SEL immunity, tolerant to Single Event Upset errors

TECHNOLOGY

Parts Selection	Space qualified Rad tolerant EEE parts, MIL-PRF-38535 QML Q/V
Boards	Double sided SMT assembly, conduction cooled cards, stiffener ribs and wedgelocks retainers

OTHER FEATURES

BITE & Protection Features:

BITE	Extensive Built-In Test (BITE) circuitry, with high security Watchdog timer
Memory Protection	Memory access protection and EDAC protected memory
FDIR	Supports Fault Detection Isolation and Recovery Function
Redundancy	C&DH unit supports redundancy at the card level: hot autonomous, and commanded cold redundancy switching.

CCSDS Tele-command and Telemetry standards:

- Telecommand decoder, with local memory for command storage, authentication and configuration.
- Compliant with packet telemetry and channel coding standards CCSD102.0-B-5 and CCSDS101.0-B-5
- On-board Time reference and Elapsed Time counter (CCSDS301.0-B-2 Time code format standard)

Software support:

Extensive selection of software development tools
 Includes device drivers and Board Support Package (BSP)
 Firmware includes S/W monitor function for debug/upload capabilities
 Ease of S/W development and testability provided by two UART Debug ports, and a Processor JTAG port

